

Claims

[c1] 1. A method for forming a contact or via plug, comprising:
forming a dielectric layer on a substrate;
forming a patterned photoresist layer on the dielectric layer;
removing a portion of the dielectric layer exposed by the photoresist layer to form a first opening by using the patterned photoresist layer as a mask;
forming a first liner on surfaces of the photoresist layer;
removing a portion of the dielectric layer under the first opening to form a second opening by using the patterned photoresist layer and the first liner as a mask, wherein the second opening incorporates the first opening;
forming a second liner on the photoresist layer covering the first liner;
removing a portion of the dielectric layer under the second opening to form a third opening exposing the substrate by using the patterned photoresist layer and the second liner as a mask, wherein the third opening incorporates the second opening;
removing the second liner, the first liner and the photoresist layer; and
filling a conductive material into the third opening to form a contact or via plug.

[c2] 2. The method of claim 1, wherein the first liner and the second liner have etching rates lower than an etching rate of the dielectric layer.

[c3] 3. The method of claim 1, wherein each of the first liner and the second liner comprises a polymer layer.

[c4] 4. The method of claim 1, wherein the dielectric layer comprises silicon oxide.

[c5] 5. The method of claim 1, wherein forming the first liner and the second liner comprises performing a plasma-enhanced chemical vapor deposition (PECVD) process.

[c6] 6. The method of claim 5, wherein the PECVD process uses a reaction gas mainly comprising CH_2F_2 , $\text{CH}_2\text{F}_2/\text{C}_4\text{F}_8$ mixture, or $\text{CH}_2\text{F}_2/\text{CHF}_3$ mixture.

[c7] 7. The method of claim 5, wherein the PECVD process further uses an optionally additive gas including argon (Ar), carbon monoxide (CO), oxygen (O_2) and

nitrogen (N₂).

- [c8] 8. The method of claim 5, wherein the PECVD process is performed under a pressure of 1~100 mTorr.
- [c9] 9. The method of claim 5, wherein the PECVD process is performed with a power of 500~2000 W.
- [c10] 10. A method for forming a contact or via plug, comprising:
 - forming a dielectric layer on a substrate;
 - forming a patterned photoresist layer on the dielectric layer;
 - removing a portion of the dielectric layer exposed by the photoresist layer to form a first opening by using the patterned photoresist layer as a mask;
 - removing the photoresist layer;
 - forming a first liner on the dielectric layer and in the first opening;
 - removing a portion of the dielectric layer under the first opening to form a second opening by using the first liner as a mask, wherein the second opening incorporates the first opening;
 - forming a second liner on the dielectric layer covering the first liner;
 - removing a portion of the dielectric layer under the second opening to form a third opening exposing the substrate by using the second liner as a mask, wherein the third opening incorporates the second opening; and
 - filling a conductive material into the third opening to form a contact or via plug.
- [c11] 11. The method of claim 10, further comprising removing the second liner and the first liner before filling a conductive material into the third opening.
- [c12] 12. The method of claim 10, wherein the first liner and the second liner have etching rates lower than an etching rate of the dielectric layer.
- [c13] 13. The method of claim 10, wherein the first liner and the second liner comprise silicon nitride.
- [c14] 14. The method of claim 10, wherein the first liner and the second liner comprise a metal.
- [c15] 15. The method of claim 10, wherein the dielectric layer comprises silicon

oxide.

[c16] 16. A method for forming a contact or via plug, comprising:
forming a dielectric layer on a substrate;
removing a portion of the dielectric layer to form a first opening;
forming a first liner on the dielectric layer and in the first opening;
removing a portion of the dielectric layer under the first opening to form a
second opening by using the first liner as a mask, wherein the second opening
incorporates the first opening;
forming a second liner on the dielectric layer covering the first liner;
removing a portion of the dielectric layer under the second opening to form a
third opening exposing the substrate by using the second liner as a mask,
wherein the third opening incorporates the second opening; and
directly filling a conductive material into the third opening to form a contact or
via plug without removing the first liner and the second liner in advance.

[c17] 17. The method of claim 16, wherein the first liner and the second liner have
etching rates lower than an etching rate of the dielectric layer.

[c18] 18. The method of claim 16, wherein the first liner and the second liner
comprise silicon nitride.

[c19] 19. The method of claim 16, wherein the first liner and the second liner
comprise a metal.

[c20] 20. The method of claim 16, wherein the dielectric layer comprises silicon
oxide.